DRAFT
Preliminary Project Execution Plan

for

The B Physics at the Tevatron (BTeV) Project

at

Fermi National Accelerator Laboratory

July 30, 2004

BTeV Project
Project Execution Plan

Submitted by Integrated Project Team

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1. Introduction

The purpose of the project is to fabricate the BTeV detector and install it in the C0 Collision Hall and Counting Room in a state ready to take data and to provide it with a source of high luminosity proton-antiproton collisions in the C0 Interaction Region. The detector, a forward spectrometer, covers the forward rapidity region with respect to the antiproton beam. The detector will permit the experimenters to study the decays of produced particles containing b-quarks and charm quarks to search for Charge Parity (CP) violation, mixing and other rare processes. The ultimate goal is to find physics that is not described by the Standard Model description of these processes and therefore represents new physics beyond the Standard Model. The key areas where BTeV excels are in the ability to study decays of the B_s meson and to study decays of B mesons and baryons that contain photons and π^o's in the final state. Achievement of the necessary sensitivity requires modifications to the accelerator to produce high luminosity at the C0 Interaction Region.

1.1 Purpose and Context of This Document

This DOE *Preliminary Project Execution Plan* (PPEP) for the BTeV Project describes the state of project planning at the time of Critical Decision 1, "Approve Alternative Selection and Cost Range." It covers the same topics and has the same structure that as the final Project Execution Plan (PEP) but does so in less detail. Ranges are used for cost estimates, schedules, and milestones. Some sections may not be fully detailed;, however, the PPEP should be quite representative of the final PEP.

The final PEP will summarize the mission need and justification of the project, its objective and scope, the Department of Energy (DOE) management structure, the resource plan, and the environmental, safety, and health (ES&H) requirements. In addition it establishes the technical, cost, and schedule baselines. DOE Baseline Change Control thresholds are also established in this document.

The project is being carried out by the Universities Research Association, which operates Fermi National Accelerator Laboratory (Fermilab) under a performance based contract with DOE. The BTeV Project Management Plan (PMP) describes the organization and systems that Fermilab will employ to manage the execution of the project and report to DOE. The PMP also establishes the more detailed lower-tier milestones against which Fermilab and the DOE BTeV Project Director will measure project performance.

1.2 Approval and Revision

The PEP is approved by the Director, Office of Science, as a prerequisite of Critical Decision 2, Approval of Performance Baseline. Revisions to the PEP that are required to incorporate baseline change actions are considered to be approved by virtue of the corresponding baseline change.

The BTeV Project Management Plan is approved by the DOE BTeV Project Director.

2. Justification of Mission

The Justification of Mission Need for the project is contained in the “CD-0, Approve Mission Need for the BTeV Project” document that was approved on February 17, 2004.

3. Project Description

The High Energy Physics program of the DOE Office of Science conducts basic research at Fermi National Accelerator Laboratory (Fermilab) utilizing the Tevatron Collider, which collides protons and antiprotons with center of mass energy of 2 TeV. These collisions produce copious numbers of particles containing b-quarks, whose decays have been shown to exhibit the property of “CP violation,” an asymmetry between the decays and mixing of b-particles and their corresponding anti-particles.

3.1 Scientific Objectives

Because the Standard Model is very specific in its description of CP violation in the b-quark sector, it is possible to look for departures or inconsistencies with respect to the Standard Model predictions that would signify new physics. Nearly every proposed theory containing new physics has the possibility of additional CP violation. Thus, these studies address some of the most fundamental issues in particle physics and could be crucial in determining the true nature of new phenomena discovered at the Tevatron or the LHC. The BTeV detector is a new, dedicated detector designed to perform a complete and comprehensive study of b-quark decays at the Tevatron.

3.2 Technical Goals

The general technical goals of the BTeV Project are presented below. The basic objective is to produce a detector, the BTeV Detector, which can perform the state of the art study of CP violation and rare phenomena in B decays; to provide very high luminosity in the interaction region where this new detector will reside; and to construct an experimental infrastructure nearby that will support the experiment. There are three subprojects: the BTeV Detector subproject; the C0 Interaction Region subproject; and the C0 Outfitting subproject. Further details can be found in the Conceptual and Technical Design Reports for the BTeV Project.

<u>The BTeV Detector Subproject</u>

The BTeV Detector subproject will consist of fabrication/installation of the items below. It will also include integration and technical commissioning activities for all components and to connect them to the trigger, data acquisition, and slow control and monitoring systems

- large spectrometer dipole magnet, construction of toroid magnet used in the muon system, and fabrication of interconnecting beam-pipe;
- state-of-the-art silicon pixel detector;
- Ring Imaging Cherenkov Counter (RICH) to provide charged particle identification (electrons, muons, pions, kaons, and protons);
- electromagnetic calorimeter based on lead tungstate crystals to provide outstanding π^o, γ and η detection and reconstruction;
- muon detector, based on an iron absorber/toroid and proportional tubes for measuring the muon trajectory;
- forward straw tracker, consisting of 4mm diameter straw tubes;
- forward silicon tracker, consisting of 100μm pitch single-sided silicon Microstrip detectors;
- trigger system to select all events whose decay contains a displaced vertex characteristic of a decaying B-meson or baryon; and
- data acquisition system to record up to 4000 candidate B decays per second.

<u>The C0 Interaction Region Subproject</u>

The C0 Interaction Region subproject will consist of fabrication/installation of:

- beamline straight section and a wire target station for parasitic testing of BTeV detector components as they are completed; and
- upgrade of the C0 Interaction Region to produce high luminosity, 1 to 2 × 10^{32} $cm^{-2}s^{-1}$, to enable BTeV to achieve its design sensitivity.

<u>The C0 Outfitting Subproject</u>

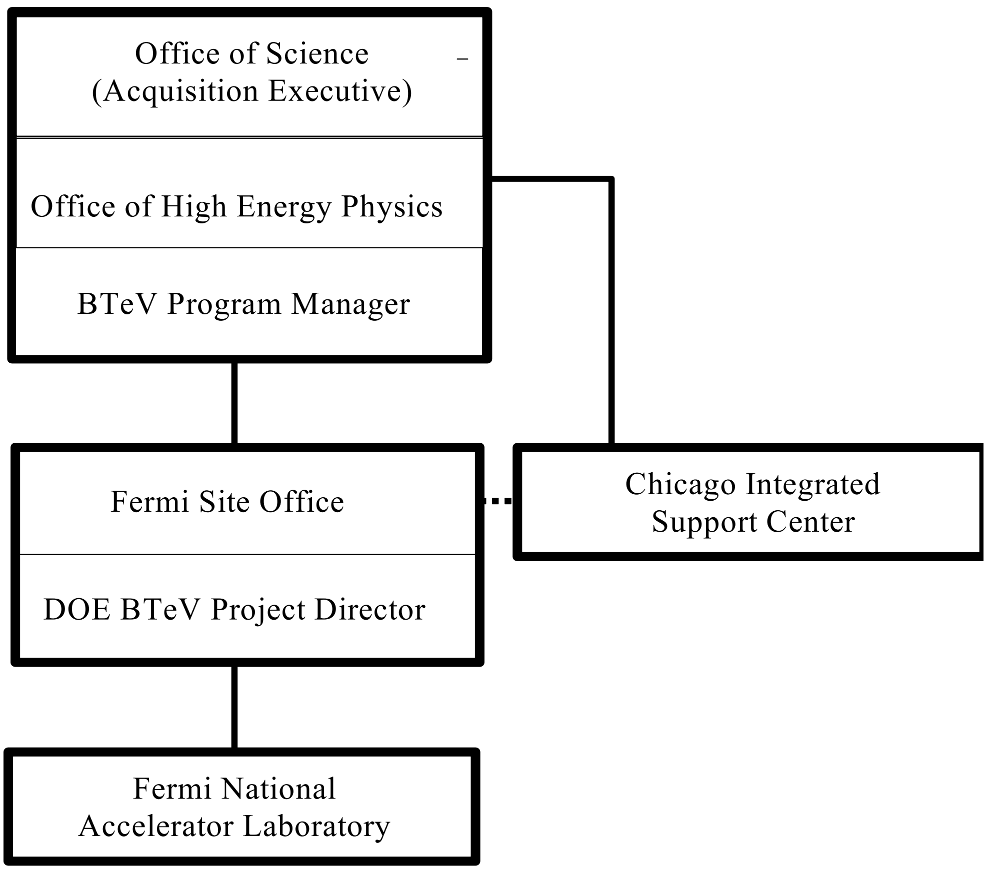
The C0 Outfitting subproject will consist of fabrication/installation of:

- architectural finishes, mezzanine structures, heating, ventilation, air conditioning (HVAC), process piping systems, and power to support the BTeV detector; and
- upgrade of the C0 Service Building, including architectural modification, HVAC and power to support the Interaction Region at C0.

4. Management Structure and Responsibilities

The DOE organization for the BTeV Project is shown in Figure 4.1. Each of the major organizational elements is discussed below the figure.

Figure 4.1
BTeV Project
Project Management Organization



4.1 Office of High Energy Physics

Within the Office of Science, the Office of High Energy Physics has overall DOE responsibility for the development of High Energy Physics (HEP). The Director of the Office of Science will serve as the Acquisition Executive for this project. The Office of High Energy Physics (OHEP) is the lead program organization for the BTeV Project. The prime headquarters point of contact for the project will be the BTeV Program Manager, an OHEP employee who is appointed by the Associate Director of the OHEP.

The responsibilities of OHEP relating to the project include the following:

- participate and concur in annual budget process;
- review the PEP and substantive changes to it;
- review the initial cost, schedule, and technical baselines;
- perform project management reviews on a roughly semiannual basis;
- ensure that funding is provided on a timely basis;
- coordinate project needs within DOE headquarters; and
- coordinate with the DOE BTeV Project Director.

4.2 SC Integrated Support Center and Fermi Site Office

The Office of Science Integrated Support Center provides support to the Fermi Site Office (FSO), e.g., in the areas of legal, ES&H, and procurement. FSO is the responsible DOE office on site at Fermilab that administers the contract and provides day-to-day DOE oversight of the laboratory. The FSO Manager has assigned the DOE BTeV Project Director the authority for day-to-day implementation and direction of the project. The FSO Manager will provide the DOE BTeV Project Director with support from FSO staff when appropriate.

4.3 DOE BTeV Project Director

The management responsibility, authority, and accountability for day-to-day execution of the project has been assigned to the DOE BTeV Project Director. The DOE BTeV Project Director is a DOE employee who is appointed by the FSO Manager, subject to the approval of the Director of the Office of Science. The DOE BTeV Project Director receives guidance and direction from the OHEP and serves as the principal point of contact for DOE headquarters on issues specific to the project.

Specific responsibilities of the DOE BTeV Project Director are:

- serve as Integrated Project Team lead in drafting/coordinating the Acquisition Strategy and PEP;
- review and approve the Project Management Plan and subsequent revisions;
- implement procedures for baseline management and control, approve baseline changes at Level 2 and recommend changes or corrective action to baselines above Level 2;
- maintain close contact with the activities of Fermilab to assure that the goals and schedules are met in a timely and effective manner. Review project performance monthly and keep the OHEP informed of cost, schedule, and technical progress and problems in a timely manner;
- control the project contingency funds and authorize its use within levels established in the Project Execution Plan;

- coordinate with the FSO Manager regarding approval of subcontract procurement actions performed by Fermilab;
- oversee the preparation and review of the safety analysis documents;
- direct the updating of the Project Execution Plan and the Project Management Plan;
- coordinate updates of the budget;
- participate in and provide support for the program peer reviews, reviews by oversight committees and validation of the project;
- submit quarterly reports and other reports on the status of the project for DOE management as required in this Project Execution Plan and applicable DOE requirements;
- aid in the compliance by the BTeV Project with appropriate DOE requirements, and contracting regulations.

4.4 Fermi National Accelerator Laboratory

The Universities Research Association, Inc. (URA) manages and operates Fermilab for DOE under the terms and conditions of Contract No. DE-AC02-76CH03000. URA has provided the Laboratory Director with the overall responsibility for all projects, programs, operations, and facilities at Fermilab. Fermilab will have the responsibility of completing the BTeV Project within the technical, schedule, and cost baselines defined in the PEP.

The BTeV Project Office performs management and oversight of the BTeV Project. The head of the Project Office is the BTeV Project Director. The BTeV Project Manager reports to the Project Director and is ultimately responsible for delivering the project scope on schedule and within budget. The Project Manager has the day-to-day responsibility for managing the Project Office. The staff of the Project Office provide management, technical, and administrative support to assist the BTeV Project Director and Project Manager in accomplishing their tasks. Fermilab's organization for the BTeV Project is shown in figure 5.1 below.

Fermilab has developed procedures to support the project office in its work and to ensure good coordination between the project and the rest of the lab. In the Fermilab Directorate is the Office of Project Management Oversight (OPMO) whose purpose is to increase the visibility of and the attention paid to large projects and to ensure their completion on-time and within budget while delivering the agreed upon scope. The role and functions of the OPMO include: providing assistance in the planning preparation, execution, monitoring, review, assessment, and management of large projects within the laboratory. The OPMO reports to the Deputy Director of Fermilab.

The Deputy Director chairs the BTeV Project Management Group (PMG) that meets as required to monitor the progress of the project. The primary task of the PMG is provide coordination between the project and the rest of the lab. The group normally consists of the BTeV Spokesperson and Deputy, the BTeV Project Director and Deputy and Project

Manager, the Heads of participating Divisions and Sections, Laboratory Management personnel, and other representatives of Fermilab and BTeV. Any conflicts between the project and the rest of the lab are identified and resolved through the PMG. These can include resolving schedule conflicts and setting priorities on the use of skilled manpower.

The BTeV Project Management Plan (PMP) parallels the DOE PEP. It documents Fermilab's plan for carrying out the project. It has lower level details such as level 2 and lower milestones, the detailed procedures for running the project, and it describes the roles and responsibilities of the BTeV Project Director, the BTeV Project Manager, Fermilab, the funding agencies, advisory groups and the BTeV collaboration.

5. Work Breakdown Structure (WBS)

The technical description of the BTeV Project is presented in the BTeV Project Technical Design Report (TDR). The TDR describes the principal components of the BTeV Detector subproject, the C0 IR subproject, and the C0 Outfitting subproject and serves as reference for the following descriptions of subsystems. Subsystems are the basis for defining the high-level WBS of the project. The WBS for the BTeV Project to level 3 is shown in Figures 5.1. Installation is included as part of the project. Further details of the WBS are available in the PMP and resource-loaded cost and schedule materials.

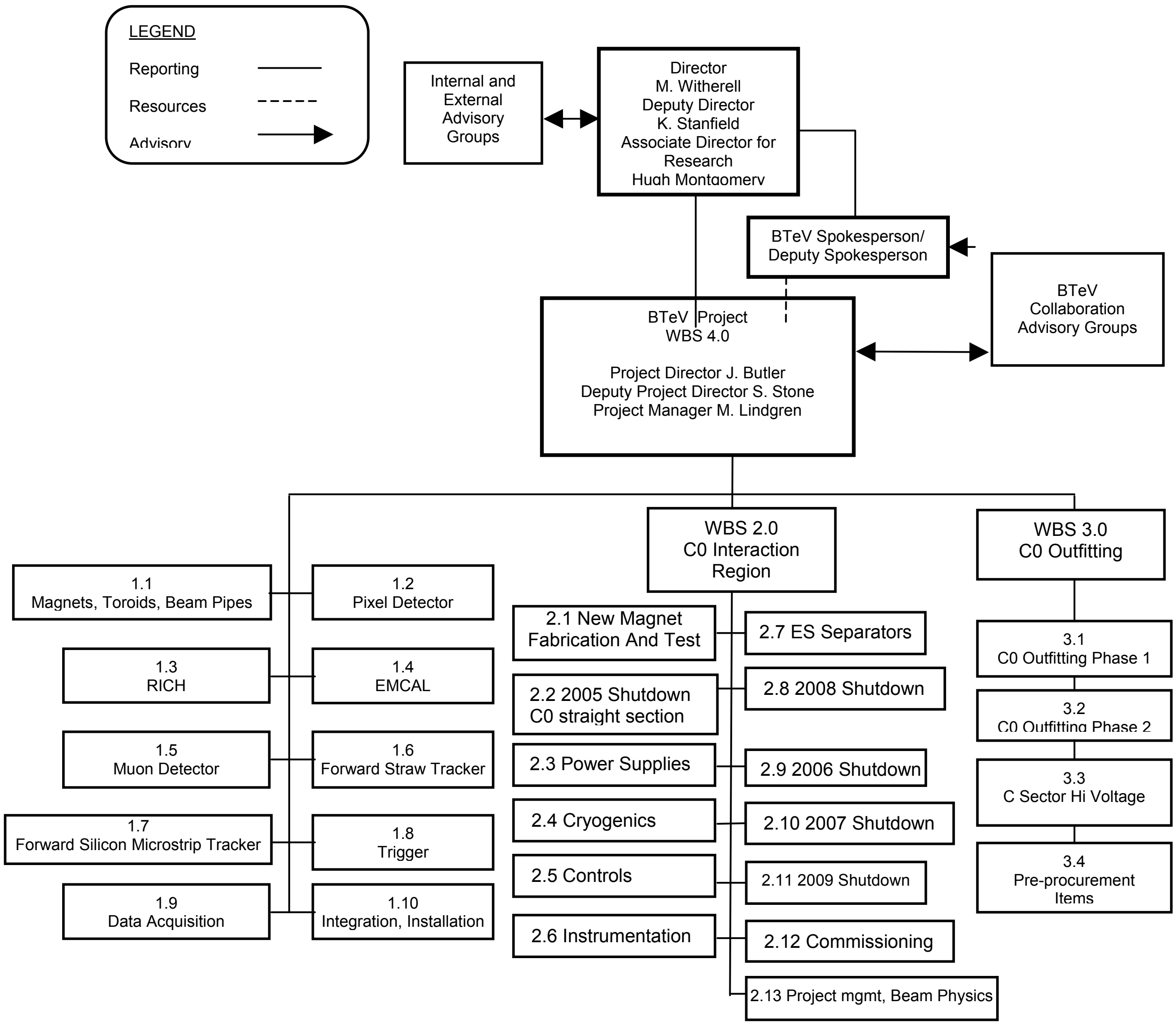


Figure 5.1: WBS Structure for the BTeV Project

6. Resource Plan

BTeV is a Major Item of Equipment (MIE), and consistent with the FY 2006 DOE budget call both Total Estimated Cost (TEC) and Other Project Costs (OPC) will be accounted for. The table below shows the estimated resources currently planned for the project, broken down by OPC, TEC, and Total Project Costs (TPC).

Table 6.1
Estimated Funding (Then Year M$)[1]

	OPC	TEC	TPC
FY 2004	4		4
FY 2005	5.6[2]	6.75[3]	12.35
FY 2006	2-3	39-48	41-51
FY 2007	2-3	49-58	51-61
FY 2008	1-2	49-58	50-60
FY 2009	2-5	40-43	42-48
FY 2010	0	3-7	3-7
Total:	**17-23**	**187-221**	**204-244**

7. Project Baselines and Control Levels

The project baselines and control levels are defined in a hierarchical manner that provides change control authority at the appropriate management level. The highest level of baseline change control authority is defined as Level 0. Changes at Level 0 are approved by the DOE Deputy Secretary. Changes below Level 0 are approved as follows:

- Level 1: Acquisition Executive (Director, Office of Science);
- Level 2: DOE BTeV Project Director;
- Level 3: Fermilab as specified in the BTeV PMP.

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[1] Escalation rates used are the January 2003 DOE R&D non-labor escalation rates starting with FY 2003: 2.3%, 2.8%, 2.7%, 2.6%, 2.5%, 2.5%, 2.5%, 2.5%.

[2] The $5.6 million OPC in FY2005 includes $3.5 million of R&D and $2.1 million for long-lead procurements associated with the spares, e.g., superconductor wire and magnet steel.

[3] Funds engineering design work to support the final design. Approval of Start of Full Construction occurs in late FY 2005 or early FY 2006.

Change control thresholds for the project are presented in section 7.1. The technical, cost, and schedule baselines and the associated control levels down to Level 2 are presented in sections 7.2, 7.3, and 7.4.

The change control levels and procedures at Level 3 and below are addressed in the PMP.

7.1 Baseline Change Control

Change control thresholds are all as stringent or more stringent than required by DOE Order 413.3. They are presented in table 7.1.

Table 7.1

BTeV Project

Technical, Schedule, and Cost Baseline Control Levels*

	Secretarial Acquisition Executive (Level 0)	Acquisition Executive (Level 1)	DOE BTeV Project Director (Level 2)
Technical	Any change in scope and/or performance that affects mission need requirements.	Changes to scope that affect mission need.	
Schedule	6 month or greater increase (cumulative) in the original project completion date.	Any change to level 1 milestones.	Any change to level 2 milestones (see PMP).
Cost	Increase in excess of $25M or 25% (cumulative) of the original cost baseline.	Any increase in Total Project Cost and/or increase in Total Estimated Cost.	Any use of contingency that would take the contingency as percentage of TEC ETC below 28%.

* Changes must be recommended at all applicable lower levels prior to being forwarded to the next higher level for consideration.

7.2 Technical Baseline

The project comprises completing the subsystems shown in the BTeV Project WBS chart, Figure 5.1. Also included is “technical commissioning,” defined as commissioning with pulsers, calibration systems, beam spray, and cosmic rays but not with Tevatron collisions. Commissioning with actual 1 TeV on 1 TeV proton-antiproton collisions will be included in planning but is not considered part of the project. The technical definition of project completion for the BTeV Project is listed in Table 7.2.

Table 7.2

CD-4, Project Closeout Definition

Subsystem	Technical Definition of Subproject Completion
BTeV Detector	All detector and counting room trigger and data acquisition systems installed, powered, and satisfying their "technical commissioning" requirements as defined above.
C0 IR	Components installed, surveyed, and powered at design currents and instrumentation read into the Accelerator controls systems and checked out
C0 Outfitting	All facilities accepted for completion as specified in contracts, all utilities hooked up, and passing acceptance and safety tests.

7.3 Cost Baseline

Table 7.3 below presents the preliminary cost baseline for the BTeV Project. Baseline costs resulted from bottoms-up cost estimates, and contingency is provided by DOE. In addition, discussions are in progress with the INFN, in Italy, and the US NSF and it is hoped that they will provide some funding for the project. Contingency is included in the TPC estimate. Current indications are that the project may be able to be baselined at the low end of the TPC range.

Table 7.3 BTeV Project

Project Cost by WBS Element ($ in Millions)

WBS Element	Item	Cost Range TEC	Cost Range TPC
1.0	BTeV Detector Subproject	131-152	139164-163
2.0	C0 Interaction Region Subproject	41-47	50-58
3.0	C0 Outfitting Subproject	7-10	7-10
4.0	BTeV Project Management	8-12	8-12
	TOTAL	**187-221**	**204-244**

*Contingency is included in the TPC estimate. Current indications are that the project may be able to be baselined at the low end of the TPC range.

7.4 Schedule Baseline

Table 7.4a below presents the schedule baselines for the BTeV Project. There is one milestone that is held by the Secretarial Acquisition Executive.

BTeV uses a system of “tiered” milestones. Milestones are established during the development of the resource-loaded cost and schedule. These are reviewed by the Fermilab BTeV Project Manager who selects a subset, called Level 3 milestones to be monitored jointly by the Project Manager and Fermilab management. From these, a smaller number, called Level 2 milestones, are selected to be monitored and controlled by the DOE BTeV Project Director. From those, a smaller number of Level 1 are selected to be monitored and controlled by the Office of Science Acquisition Executive.

At each level, milestones are chosen from the lower level based on the following criteria: significance in judging the progress of the project; relatively uniform distribution throughout the lifetime of the project; proximity to the critical path; and distribution across the WBS Level 1 subprojects. The eight Level 1 milestones of the BTeV Project, shown in Table 7.4b, meet these criteria. These milestones are preliminary milestones and, therefore, may be changed for the PEP.

Table 7.4a

BTeV Critical Decisions

Description	Date
CD-0: Approve Mission Need	February 17, 2004
CD-1: Approve Alternative Selection and Cost Range	4th Quarter FY04
CD-2: Approve Performance Baseline	2nd Quarter FY05
CD-3a: Approve Limited Construction	2nd Quarter FY05
CD-3b: Approve Start of Construction	4th Quarter FY05
CD-4: Approve Start of Operations or Project Closeout (Level 0 Milestone)	3rd Quarter FY11

Table 7.4b

Level 1 Milestones for the BTeV Project

No.	Description	Date
1.1	Purchase Order awarded for superconducting wire.	Jul. 2005
1.2	Beneficial occupancy of lower level and upper staging area of C0 achieved.	Jul. 2006
1.3	PO awarded for production pixel hybridization.	Oct. 2006
1.4	Vertex Magnet assembled and installed at C0.	Feb. 2007
1.5	50% of $PbWO_4$ crystals delivered and accepted.	Apr. 2009
1.6	Pixel System assembled and tested at SiDet, ready to ship to C0.	Jul 2009
1.7	IR Components that will be installed in tunnel are complete and tested.	Oct. 2009
1.8	Final delivery of $PbWO_4$ crystals for the electromagnetic calorimeter completed.	Apr. 2010
1.9	Detector complete and ready for commissioning with beam	Apr. 2011

8. Project Monitoring and Reporting

The DOE BTeV Project Director will provide quarterly reports on the BTeV Project to HQ and monthly updates to the Project Assessment and Reporting System (PARS). Monitoring of the BTeV Project will occur through established mechanisms among project participants. Reviews of the project status will be conducted by the Director of High Energy Physics approximately semiannually. Fermilab will provide formal project monthly reports to the DOE BTeV Project Director. The requirements of the monthly reports will be included in the BTeV Project PMP.

Reviews will be conducted to assist in the elimination of problems; to verify that interfaces between activities and tasks are acceptable; and to verify that the project is progressing satisfactorily. Reviews will be employed at the following levels dependent on the review purpose: BTeV Project; Fermilab; and funding agency.

9. Environment Safety and Health

9.1 National Environmental Policy Act (NEPA)

The Categorical Exclusions (B3.10 and B1.15) for the BTeV Project were approved on December 23, 2003.

9.2 Preliminary Safety Assessment Document

The radiation shielding and oxygen deficiency aspects of the existing C0 Experimental Hall have been addressed and documented in the "Tevatron Radiation Shielding Assessment," in spring of 1999, and the "Beams Division Oxygen Deficiency Hazard Assessment," dated March 1999. The C0 Experimental Hall is included in the "Beams Division Areas Safety Assessment Document," dated July 2002.

A draft BTeV Hazard Assessment Document has been prepared for this specific experiment and will serve as the basis for the Preliminary Safety Assessment Document required for CD-2. A Safety Assessment Document (SAD) will be prepared prior to sustained operations of the completed BTeV Detector. The Interaction Region portion of the project will be covered by the existing Accelerator Division SAD or modification thereof.

9.3 Integrated Safety Management

The BTeV Project will be constructed and operated under the Integrated Safety Management (ISM) plan developed by Fermilab in consultation with DOE. The Fermilab ES&H Section, the Fermilab Particle Physics Division, Computing Division, Technical Division, Facilities Engineering and Support Section, and Accelerator Division and the project team work together to assure effective application of the ISM plan. Each project team has committees with specific oversight responsibilities for the advice and ES&H approval process.

10. Technical Considerations

10.1 Value Management

Value Management (VM) principles are essential to proper program management and have been incorporated at the early design and development stages of the technical requirements. These principles will also be employed as the cost and schedule parameters mature over time. Use of the VM approach provides a systematic framework to analyze the functions of systems, equipment, facilities, services, and supplies for the purpose of achieving the essential functions at the lowest life cycle cost consistent with required performance, quality, reliability and safety. VM elements have been incorporated as a part of each of the technical and program reviews to date.

10.2 Configuration Management

A Configuration Management Program (CMP) will be implemented that will describe the configuration management (CM) responsibilities and processes that support the design and implementation of the BTeV Project. The purpose of this CMP is to identify the organization providing the configuration control, define what a configuration-controlled item is, describe the change control process, and identify the plan for configuration status accounting and verification. The CMP is designed to ensure that:

- baselines are defined and documented;
- documentation is identified, released and controlled;
- a Configuration Control Board (CCB) is established and functions according to CMP guidelines;
- changes to the baseline are evaluated and controlled;
- approved configuration changes are implemented and tracked; and
- configuration status accounting is accomplished.

Systems and components specific to the BTeV Project will be reviewed in accordance with the principles provided in ANSI/EIA-649-1998, *National Consensus Standard for Configuration Management*. The degree of rigor employed will be tailored, based on the functions and importance of each system or component.

10.3 Quality Assurance

Quality Assurance is an integral part of the design, fabrication and construction of the BTeV Project. Special attention is paid to items that are most critical to the schedule and performance requirements of the project. All work performed at Fermilab will draw on the guidelines and criteria set out in Fermilab Director's Policy Manual, document #10.000. Quality Assurance will include:

- management criteria related to organizational structure, responsibilities, planning, scheduling, and cost control;
- training and qualifications of personnel;
- quality improvement;
- documentation and records;
- work processes;
- engineering and design;
- procurement;
- inspection and acceptance testing; and
- assessment.

Achieving a quality end product is a line responsibility that extends from the bottom of the Organizational Breakdown Structure (OBS) to the top. All levels of personnel in the project are encouraged to report performance problems and to encourage others to report problems as they are discovered. Stop Work Authority related to quality of work is given to all managers and supervisory personnel within the project. They are authorized and expected to halt unsatisfactory work being performed by any of the individuals or organizations reporting to them. The Division Head, Project Director, and Project Manager may specify other stop work authority outside of the normal management chain at their discretion.

The objective is to identify problems related to quality early in the process at a time when cost effective, timely corrections can be implemented easily. Specifically, each subproject will hold regular meetings to discuss construction status and performance, where an emphasis is placed on identifying and correcting problems. The project will hold regular meetings at which Level 2 and Level 3 managers will report on the status and problems of their subprojects. Corrective actions will be taken, using the appropriate and well defined level of change control, to solve these problems. These are normal, well understood project management techniques that have been used successfully in HEP projects many times in the past.

In addition, the BTeV project has undertaken some extensions to that normally employed, in an attempt to further raise the level of quality throughout the life of the project by adding a small number of Quality Assurance specialists. While QA is a line responsibility, in a project where the Level 2 and Level 3 managers are highly skilled technical people, having a trained QA specialist assisting in developing and implementing advanced QA/QC processes in the distributed production environment inherent in the collaborative project process should provide an additional level of quality to the project.

One specialist in Quality Assurance and procurement will work in the Project Office. The duties of this person will include assisting the Project Manager in conducting Production Readiness Reviews, working with Level 2 and Level 3 managers to design and implement the latest, state of the art, QA procedures in their subprojects, and supervision of the QA aspects of all major internal and external procurements. It is expected that this person will travel extensively to university collaborators and sub-contractors to train, and then monitor the QA process there.

One sub-project where the production is distributed over three remote sites will have a dedicated Quality Assurance technical specialist for the duration of the project, to assure that the production is done to uniform, and high, standards. This person will travel between the three sites. The addition of specifically trained personnel in this area should have a beneficial effect on QA/QC throughout the project, as their knowledge is disseminated throughout the project personnel.

11. Risk Management

Every effort has been made to specify the project in a manner that reduces the level of risk to an acceptably low level.

The IPT expects the project to manage risk according a formal Risk Management Plan (RMP). A draft of the RMP has already been prepared. The plan establishes risk management as a line responsibility. Risks are identified by WBS Level 2 managers and ranked within their projects based on probability of occurrence and impact/consequence. BTeV Project management reviews the results and classifies the risks as high, medium, or low based on a “Risk Classification Matrix.” Included in this process are high level risks and risks that might be shared among several subprojects that may be identified and “owned” by the Project Manager.

The Level 2 managers then develop Risk Mitigation/Abatement Plans for all risks rated as either high or moderate. Risk information will be included in the OpenPlan Scheduling database. The Project Manager will establish and maintain a “watch-list” of risk issues and events that need special attention or on which action is imminent. The development of risk abatement strategies and plans and their execution is monitored by a Risk Management Board (RMB) that consists of consists of the BTeV Project Manager, BTeV Project Director, ES&H and QA coordinators, and selected Technical Board members.

There will be a formal “risk management coordinator” on the RMB who will assist the Project Manager in carrying out responsibilities in this area. The RMB will meet at least quarterly. Risk Management issues will be regularly addressed at the weekly Technical Board meetings and will be included in monthly reports.

Technical risk has been minimized by limiting advanced technologies to those subsystems that reap the largest benefit, the pixel detector and the electromagnetic calorimeter. While the chosen technologies are not in use in a current running major experiment, both are under construction for the Compact Muon Solenoid experiment at the Large Hadron Collider. Other systems are designed with well tested technologies that have been used in running experiments.

Use of fixed-price subcontracts and competition will be maximized to reduce cost risk.

Schedule risk will be minimized via:

- realistic planning;
- verification of subcontractor’s credit and capacity during evaluation;
- close surveillance of subcontractor performance;
- advance expediting; and

- incremental awards to multiple subcontractors for the same item when necessary to assure total quantity or required delivery.

Incentive subcontracts, such as fixed-price with incentive, will be considered when a reasonably firm basis for pricing does not exist or the nature of the requirement is such that the subcontractor's assumption of a degree of cost risk will provide a positive profit incentive for effective cost and/or schedule control and performance.